Defence Seminar

Seminar Title	: Performance Improvement of DTC-based Induction Motor Using Adaptive and Predictive Control Techniques
Speaker	: Abhimanyu Sahu (Rollno : 518ee1009)
Supervisor	: Kanungo Barada Mohanty
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Abstract

: In the rapidly evolving field of electrical drives, there is an increasing demand for methods of effective and precise control. This dissertation focuses on the development of advanced control strategies to enhance the performance of induction motor drives (IMD) through improved Direct Torque Control (DTC) techniques. Traditional DTC methods often suffer from issues such as high switching frequency, limited disturbance rejection, and complex real-time implementation. To address these challenges, several innovative approaches are proposed and validated.

Initially, an Adaptive Fuzzy Sliding Mode (AFSM) controller is integrated into the DTC scheme to improve torque, speed, and stator current control. By employing adaptive fuzzy logic, the AFSM-DTC method significantly enhances system response and control accuracy, laying the groundwork for more advanced real-time control strategies.

Building on this, a Neural Network-based Predictive Direct Torque and Flux Control (NNPDTFC) technique is introduced. This method combines neural networks with discrete predictive control, optimized using Particle Swarm Optimization (PSO), to reduce settling time, torque and flux ripples, and improve dynamic response. A low-cost DSP controller is used for experimental implementation, proving the robustness and real-time applicability of the system under varying loads and uncertainties.

Further advancements include the application of Ant Colony Optimization to fine-tune neural network parameters, enhancing the controller's ability to handle computational complexity and dynamic changes in the system.

Finally, a Feedback Linearization (FBL)-based DTC method using a Model Predictive Intelligent Controller (MPIC) is presented. This approach decouples torque and flux control and employs space vector modulation to achieve high-performance operation with reduced ripples and faster transient response.

All proposed methods are rigorously tested using MATLAB/Simulink simulations and experimental setups with DSP2812 controllers. Results consistently demonstrate improved performance, robustness, and suitability for real-time applications.

Overall, the dissertation makes a substantial contribution to IMD control by integrating intelligent algorithms and optimization techniques, significantly advancing the precision and efficiency of DTC systems.

Online Presentation link is:

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